University of Maryland at College Park

Final Report for
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PHYSICAL PROCESSES AND SCALE INTERACTIONS IN HIGH RESOLUTION CLIMATE SIMULATIONS

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Goals. The overall goal of this project is to study the effects of increasing resolution in the GCM modelling of climate. We hope to understand the changes in the mean flow and fluctuations as the more and more small scales are resolved, and to assess the effects of the smallest scale eddies on the large scale flow. Since high resolution models are expensive to integrate, we will try to compare the merits of making a few simulations with a high resolution model compared to making a larger number of simulations with a lower resolution model.

Accomplishments. During this period we have completed the following work:

(A) Performed various simulations with the COLA spectral GCM:

(i) [R40 L18] for 24 months initialized on 1/2/87
(ii) [R40 L18] for 60 months initialized on 1/1/79
(iii)[R30 L5] for 10 months initialized on 6/1/88
(iv)[R30 L18] for 3 months initialized on 1/2/87
(v) [R15 L18] for 12 months initialized on 1/1/87

(Here [Rn Lm] refers to rhomboidal truncation with maximum wavenumber n and with m discrete levels in the vertical. The last integration was performed by Dr. Schneider and Dr. Zhu at COLA in conjunction with other research.)

(B) Diagnosed the behavior of the GCM simulations. The structure of the mean fields and stationary waves of (i)-(v) and the corresponding observations have been analyzed. A comprehensive analysis of the transient fluctuations on a variety of space and time scales has also been carried out for most of the integrations, and the corresponding observational analyses are ongoing. We have applied a technique for examining the effects of smaller scales on the larger scales via the vorticity budget, and have coded a program to calculate the rotational energy and enstrophy cascades in wavenumber space from the model output.